

Micro-scale Plasma Arc Gasification for Waste Treatment and Energy Production Project

Center Innovation Fund: KSC CIF Program | Space Technology Mission Directorate (STMD)



ABSTRACT

As NASA continues to develop technology for spaceflight beyond low earth orbit, we must develop the right systems for sustaining human life on a long duration or planetary mission. Plasma arc gasification (PAG) is an energy efficient mechanism of waste management for power generation and synthetic gas (syngas) production.

ANTICIPATED BENEFITS

To NASA funded missions:

This technology would not only create a *dynamic* shift to waste processing on board space vehicles and space habitats for long duration missions. Also provides a technology for residential, commercial and confined populations to manage their waste and possibly generate energy. Such a technology could eventually create a closed loop sustainability path.

Major benefits:

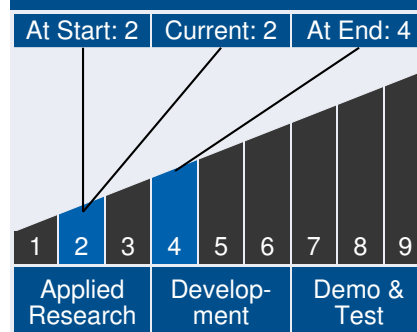
- Higher efficiency in reducing logistical waste volume on board vehicle or habitat & potentially produce useful ECLSS gases (water and oxygen)
- Requires less feed gas commodities & system hardware than current waste processing technologies that are being investigated for long duration space missions
- Would provide the ability to process a vast array of wastes on a long duration mission (i.e. medical, hazardous & food packaging) with a cleaner product stream at higher efficiency
- Provide fuel for micro thrusters on deep space mission
- Less up mass for future missions with potential energy production



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Technology Maturity



Management Team

Project Manager:

- Nancy Zeitlin

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To the nation:

- Facility waste management benefits: Technology could be implemented at centers for waste processing and syngas production
- Provides capabilities for small scale applications on earth and in space

DETAILED DESCRIPTION

Syngas can be chemically manipulated to create desired gases such as oxygen and methane on long duration missions from mission waste. Syngas can also be used directly to power small thruster engines for propulsion. PAG is a high temperature, high frequency and low volume gas emission system that dissociates organic compounds in a cleaner fashion when compared to current gasification and incineration processes utilized on Earth. PAG has only been used on large scale municipal waste systems and in this project we will demonstrate the feasibility of a micro-scale system to other waste proAs NASA continues to develop technology for spaceflight beyond low earth orbit, we must develop the right systems for sustaining human life on a long duration or planetary mission. Plasma arc gasification (PAG) is an energy efficient mechanism of waste management for power generation and synthetic gas (syngas) production. Syngas can be chemically manipulated to create desired gases such as oxygen and methane on long duration missions from mission waste. Syngas can also be used directly to power small thruster engines for propulsion. PAG is a high temperature, high frequency and low volume gas emission system that dissociates organic compounds in a cleaner fashion when compared to current gasification and incineration processes utilized on Earth. PAG has only been used on large scale municipal waste systems and in this project we will demonstrate the feasibility of

Management Team (cont.)

Principal Investigator:

- Anne Caraccio

Technology Areas

Primary Technology Area:

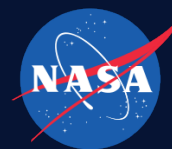
Human Health, Life Support, and Habitation Systems (TA 6)

Other Technology Areas:

- Space Power and Energy Storage (TA 3)
- Environmental Protection and Green Technologies (TA 13.2)

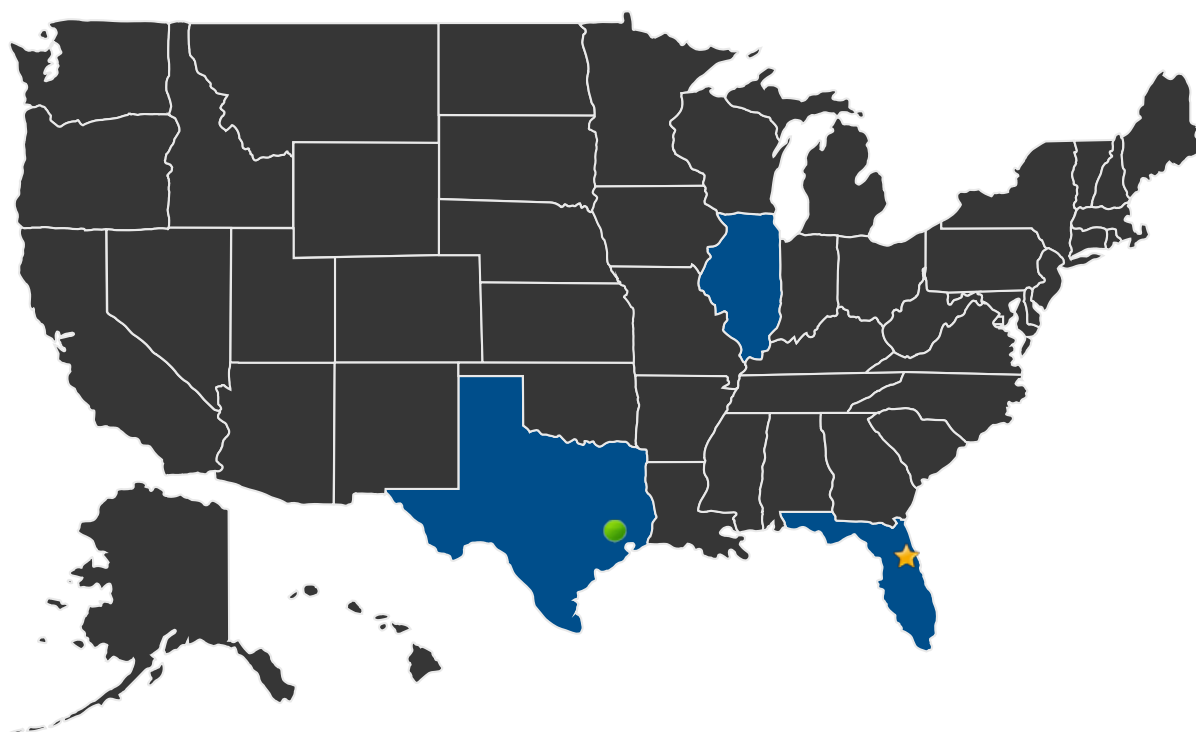
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a micro-scale system to other waste processing technologies to see if the power, mass and volume is comparable for volume reduction and energy production.

U.S. LOCATIONS WORKING ON THIS PROJECT



■ U.S. States With Work

★ **Lead Center:**
Kennedy Space Center

● **Supporting Centers:**

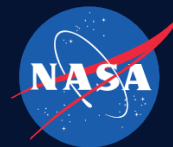
- Johnson Space Center

Contributing Partners:

- PEAT International

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DETAILS FOR TECHNOLOGY 1

Technology Title

Micro-scale Plasma Arc Gasification

Technology Description

This technology is categorized as a hardware component or part for tools

Micro-scale plasma arc gasification (PAG) is a high temperature, high frequency and low volume gas emission system that dissociates organic compounds in a cleaner fashion when compared to current gasification and incineration processes utilized on Earth. This project will demonstrate a micro-scale system for converting long duration mission waste (i.e. food packaging, hygiene items, biological waste, medical waste, etc.) into high value products.

Capabilities Provided

This technology will demonstrate the capabilities of producing fuel and other commodities for deep space missions.

Potential Applications

Medical waste treatment, small scale energy production, sustainable waste processing, clean and efficient waste processing.